

T05D012 - Thermometric Titration

Name.....

Aim

The purpose of this experiment is to determine the concentration of hydrochloric acid, HCl(aq) by thermometric titration; and having done that, to calculate the standard enthalpy change for the reaction - the standard enthalpy change of neutralization, $\Delta H_{\text{neutralisation}}$.

Introduction

You titrate hydrochloric acid with a standardized solution of sodium hydroxide and record the temperature of the mixture during the course of the titration. Plotting a graph will enable you to determine the maximum temperature rise, from which you calculate both the concentration of the acid and the enthalpy change of neutralization.

Requirements

Safety spectacles, pipette (50.0 cm^3), pipette filler, expanded polystyrene cup
sodium hydroxide solution (1.00 M standardized), thermometer, burette (50.0 cm^3),
filter funnel, hydrochloric acid, ($\approx 2 \text{ M}$).

Hazard warning

Sodium hydroxide is very corrosive. Therefore you must USE THE PIPETTE FILLER SUPPLIED and WEAR SAFETY SPECTACLES

Procedure

1. Using a pipette and filler, transfer 50.0 cm^3 of NaOH solution into the polystyrene cup. Allow to stand for a few minutes.
2. Record the temperature of the solution.
3. From a burette, add 5.0 cm^3 of HCl solution to the cup.
4. Stir the mixture with the thermometer and record its temperature.
5. Add successive 5.0 cm^3 portions of HCl solution stirring the mixture and recording its temperature after each addition.
6. Record your results in an appropriate manner. Stop after the addition of 50.0 cm^3 of acid.

Data Processing and presentation

1. Using your results draw a graph. Remind yourself what you will be doing with the graph!
2. On your graph find the point that corresponds to both the volume of acid required for neutralization and to the maximum temperature.
3. Calculate the concentration of the acid.
4. Determine the quantity of energy released in the titration.
5. Calculate the standard enthalpy change of neutralization for the reaction.

Conclusion and evaluation

After interpreting your results give a conclusion to this experiment. Remember to include an explanation. You also have the opportunity to compare your results with literature values.

You can now evaluate the procedure and results; remember to include any limitations, weaknesses or errors.

If you have identified any weaknesses suggest some realistic improvements to this investigation.